

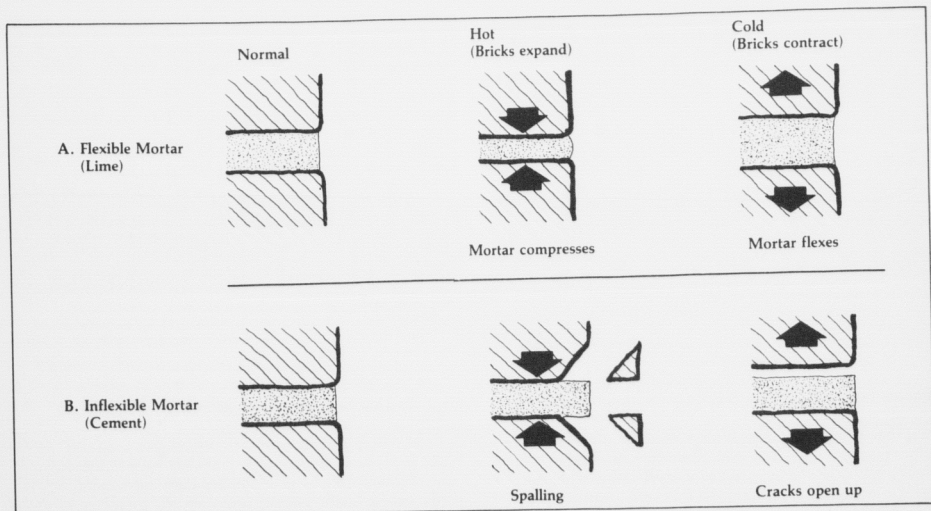


Figure 3. Diagrammatic sketches showing effects of temperature change upon masonry. Flexible mortar (A) expands and contracts with temperature changes. Bricks bonded by inflexible mortar (B) tend to spall at the edges (the area of greatest stress) in hot weather and separate from the mortar when it is cold. This latter condition opens cracks, permitting the entry of water and causing additional deterioration. Adapted from *Maintenance of Old Buildings, Document D10*; National Swedish Institute for Building Research, Stockholm, 1975.

consultant alike. The following guidelines can assist in writing specifications:

- Material proportions should be given in volumes, that is, 4 parts of lime to 12 parts of sand, rather than 2 bags of lime to 6 cubic feet of sand. This will avoid any confusion on the job site when substitution of sources occur with differing packaging sizes.
- Repointing mortar for most historic buildings should ideally be composed only of lime and sand. A proportion of 1 part of lime to 2 parts of sand is a useful starting point.
- ASTM C-150, Type II (white non-staining) portland cement may be added to the repointing mortar to increase workability or to achieve whiteness in color; however, no more than 20 percent of the total volume of the lime and portland cement—combined—should be portland cement. Above 20 percent, the portland cement increases the hardness of the repointing mortar to a potentially damaging degree.
- For surfaces of extreme weather such as parapet walls or water tables, a harder mortar (6 parts of sand, to 3 parts of lime, to 2 parts of white portland cement) may be more desirable.

Execution of the Work

The Test Panel: In choosing a contractor or mason, perhaps the best way to award the contract and for the contractor or mason to demonstrate his or her work in a repointing job is the test panel: a small demonstration section of joint preparation and repointing actually done on the historic masonry. The test panel should be carefully selected to include all types of masonry, joint styles, and types of problems to be encountered on the

job. Usually a 3-foot by 6-foot area located in an inconspicuous yet readily accessible place is sufficient.

Joint Preparation: Old mortar should generally be removed to a minimum depth of $2\frac{1}{2}$ times the width of the joint to ensure an adequate bond and to prevent mortar "popouts." For most brick joints, this will require removal of the mortar to a depth of approximately $\frac{1}{2}$ –1 inch. Any loose or disintegrated mortar beyond this minimum depth should be removed (figure 4). The use of power tools such as saws with carbide blades or impact hammers for the removal of mortar almost always results in damage to the bricks by breaking the edges and by overcutting on the head, or vertical, joints (figure 5). Damage to the bricks not only affects their visual character but can also lead to accelerated weather damage. Where joints are uniform and fairly wide, it may be possible to use a grinder to assist the removal of mortar; however, final preparation of the joint should be done by hand.

Test panels are quite helpful, but they cannot adequately assess the potential effect of using a grinder since such panels are not prepared under actual working conditions. If there is any chance of damaging the masonry, hand-methods should be used exclusively. Although slower, these methods are easier to control and less likely to cause irreversible damage to the bricks. Mortar should be removed cleanly from the bricks, leaving square corners at the back of the cut. Before filling, the joints should be rinsed with a jet of water to remove all loose particles and dust. At the time of filling, the joints should be damp but with no standing water present.

Mortar Preparation: Mortar should be mixed carefully to obtain uniformity of visual and physical characteristics.